

The Effects of Adaptation Actions and Absorptive Capacity on SaaS Benefits and Firm Performance

Full paper

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Abstract

Cloud Computing (CC) offers a new mode for companies to gain access to information and communication technologies (ICT) services, which can offer important benefits. However, limited research has been conducted about how firms will be able to accomplish the benefits of CC in order to improve their firm performance. This paper contributes to filling these research gaps by investigating empirically: 1) the effects of firm's adaptation and absorptive capacity (ACAP) on the benefits gained from CC; and 2) the impact of these CC benefits on firm performance. Data for our study have been collected through a questionnaire from 102 Dutch firms using SaaS services, which have been used for the estimation of a structural equation model (SEM). The findings show that CC adaptation has a very strong positive effect, ACAP has a medium to strong effect on benefits gained from CC, which have a strong positive effect on firm performance.

Keywords

cloud computing, software as a service (SaaS), adaptation, absorptive capacity (ACAP), benefits, performance.

Introduction

Cloud Computing (CC) constitutes a new paradigm of information and communication technologies (ICT) services acquisition by firms. In this paradigm CC services are provided by third parties from a distance to many firms, which is quite different from CC services internal provision of the traditional 'on premise' paradigm (Armbrust et al., 2010; Marston et al., 2011; Venders and Whitley, 2012; Hoberg et al., 2012; Willcocks et al., 2013; Willcocks et al., 2014; Mueller et al., 2015). CC is defined by the US National Institute for Standards and Technology (NIST) as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of computing resources (e.g., networks, servers, storage, applications) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell and Grance, 2011, p. 2). Currently a wide variety of CC services are offered, which can be grouped into three main levels: Infrastructure as a Service (IaaS) (= use of providers' remote storage and computing facilities), Platform as a Service (PaaS) (= the services mentioned above for IaaS and also data base management systems, software development languages and tools for the development and deployment of applications) and Software as a Service (SaaS) (= remote use of software applications running on providers' systems and supported/maintained by them) (Marston et al., 2011).

CC, if properly exploited and managed, can offer significant benefits to firms, which are associated with both ICT cost reduction, and also support of innovation activity, (Brynjolfsson et al., 2010; Benlian and Hess, 2011; Marston et al., 2011; Venders and Whitley, 2012; Bernman et al., 2012; Hoberg et al., 2012; Willcocks et al., 2013; Willcocks et al., 2014; Müller et al., 2015). However, limited empirical research has

been conducted on the real benefits obtained by firms from the use of CC, in order to understand to what extent the above CC benefits expectations are realized, the factors affecting these ‘real’ CC benefits, as well as the effects of the latter on firm performance (e.g. see Bayramustaa and Nasirb, 2016), despite the importance of the above questions. Though there is extensive empirical research on the factors affecting CC adoption (e.g. see Schneider and Sunyaev, 2016; Bayramustaa and Nasirb, 2016), quite limited is the empirical research conducted on the extent of the realized CC benefits, and the factors affecting them. CC is for firms a new paradigm for accessing the ICT services required for supporting their processes and activities, based on external providers, which is quite different from the previous ‘on premise’ paradigm, based on internal ICT services provision, so firms still do not know how to exploit it, in order to gain more benefits and generate more business value from CC. It is therefore quite important for firms to identify and understand the determinants and preconditions of gaining significant benefits from this new CC paradigm, and finally improving their business performance.

This study contributes to addressing this research gap by investigating the effects of two firm level factors associated with ‘change’ on the benefits gained from CC. Previous research emphasizes that critical success factor of CC, quite important for gaining significant benefits from it, is to make some changes/adaptations in the roles and the skills of firm’s ICT personnel, and also firm’s non-ICT personnel (ICT users or potential users of firm’s business units) (Willcocks et al. 2013; Willcocks et al., 2014; Ragowsky et al., 2014; Schneider and Sunyaev, 2016). These roles and skills are currently aligned with the traditional ‘on premise’ paradigm (of internal ICT services provision), so they have to be changed and adapted/aligned to the new CC paradigm (of ICT services provision). Furthermore, the same studies conclude that as there is a big and continuously increasing number of CC providers and services, and there is a continuous evolution in this area, it is of critical importance for firms adopting CC to continuously collect, process and exploit large amounts of relevant external knowledge, in order to take advantage of new opportunities, and gain benefits from them; this becomes a critical task for all the business units of the firm, and not only for the ICT unit. Therefore firm’s Absorptive Capacity (ACAP) (Cohen and Levinthal, 1989 and 1990; Zahra and George, 2002; Lane et al., 2006; Camison and Fores, 2010) plays an essential role in gaining extensive benefits of CC. ACAP is an important dynamic capability, defined as “a firm’s ability to recognize the value of new external information, assimilate it, and apply it to commercial ends, and in general for achieving firm’s objectives” (Cohen and Levinthal, 1990, p. 128), which becomes quite important for the generation of high levels of benefits from CC, in the rapidly evolving CC services market. Therefore the research objectives of this study are to investigate empirically:

- i) the effects of firm’s adaptation and ACAP on the benefits gained from CC*
- ii) the impact of these CC benefits on firm performance*

Our study is based on data collected from 102 Dutch firms using SaaS services through a questionnaire.

This paper consists of six sections. In the next section the background of our study is presented, while in the following one the research hypotheses are formulated. Then there is a section describing the data and the method of this study, followed by a section presenting and discussing the results. The final section summarizes the conclusions and suggests future research directions.

Background

Cloud Computing Benefits

Previous CC literature has discussed extensively the wide range of significant benefits that CC can offer to firms. These benefits include reduction of the costs of the ICT support of their processes and activities, conversion of related capital investments to operating costs, rapid and low cost development of technological support required for process, product and service innovations, scalability, ubiquitous access, provision of flexible cost-effective computing capacity for supporting firm’s growth, and rapid and low cost access to new technologies (e.g. business analytics, mobile) and high level ICT-related skills (Etro, 2009; Armbrust et al., 2010; Brynjolfsson et al., 2010; Iyer and Henderson, 2010 and 2012; Marston et al., 2011; Venters and Whitley, 2012; Willcocks et al., 2013; Berman et al., 2012; Müller et al., 2015).

However, limited empirical research has been conducted in order to investigate to what extent the above potential benefits are realized; to what extent are the expected benefits gained by firms, and which factors

determine their magnitudes? We searched for previous relevant literature, using as keywords ‘cloud’, or ‘SaaS’, or ‘ASP’, in combination with ‘benefits’, or ‘value’ or ‘success’, and we found only two empirical studies. Malladi and Krishnan (2012) collected data through a survey from 243 USA firms and estimated a regression model of the effect of SaaS on ICT-enabled innovation capability. They found that the use of SaaS has a positive impact on ICT-enabled innovation (in products, services or processes), which increases if there is previous ICT outsourcing experience, flexibility of firm’s ICT infrastructure and process management maturity. Garrison et al. (2015), using data collected from 302 Korean firms, estimated a structural equation model (SEM) that connects ICT technical, managerial and relational capabilities with CC success and finally firm performance. They conclude that all these three capabilities affect positively the degree of CC success (with the effect of the ICT relational capabilities, concerning the relations with the CC services providers, being the strongest, followed by the effects of the ICT technical capabilities, and then the ICT managerial capabilities); also the degree of CC success affects positively firm performance.

Our review shows that only a small number of factors affecting CC benefits have been investigated empirically in previous research: firm’s ICT outsourcing experience, flexibility of firm’s ICT infrastructure, process management maturity (Malladi and Krishnan, 2012), and also ICT technical, managerial and relational capabilities (Garrison et al., 2015). Hence, there is limited understanding of the impact and contribution of other factors. Our study contributes to addressing this research gap, by investigating the effects of firm’s adaptation to CC, as well as ACAP, on CC benefits, and finally on firm performance.

Cloud Computing Adaptation

Previous literature (Willcocks et al. 2013; Willcocks et al., 2014; Ragowsky et al., 2014; Schneider and Sunyaev, 2016) argues that the adoption of CC necessitates significant changes in the roles and the skills requirements of firm’s both ICT and non-ICT personnel, in order to exploit the benefits’ potential of CC. The CC changes significantly the way ICT services are provided in comparison with the previous ‘on-premise’ paradigm. In an ‘on-premise’ situation ICT services are produced mainly internally, based on hardware and software installed in firm’s premises, administered and supported by its ICT personnel. On the contrary, in the CC paradigm the ICT services are produced externally, at the CC providers’ premises, and are provided to the firm through the Internet. This necessitates some adaptations to this new ICT services acquisition paradigm of the skills and the roles of firm’s both ICT and non-ICT personnel.

In particular, the ICT personnel gradually become less technical and more business oriented. Their activities include less systems development, administration and support, and now focus on integration between on-premises systems and various external CC services. Also more co-operation with the non-ICT personnel (ICT users of the business units) is needed 1) to explore the existing and continuously evolving and increasing CC services offered by multiple providers, 2) to assess these services with respect to firm’s needs (for supporting their activities and business processes, as well as for innovating firm’s products, services and even business models), 3) to select the most appropriate CC services, 4) to negotiate with the corresponding providers, and 5) to monitor the provision of these services, and in general manage relevant contracts. Often the business units tend to adopt various SaaS services, which provide good support of their tasks, without consent or co-ordination from the ICT unit, and this can lead to serious problems (e.g. concerning integration, security, costs, etc.). The ICT unit has to convince the management and the business units that a coordination of SaaS services purchase and usage, as well as relevant guidance/training of business units, will be highly beneficial, and undertake this role. These will necessitate extensive training of existing ICT personnel (concerning the CC technologies, integration of them with on-premises systems, contracts management, as well the operations, business processes and external environment of the firm), who can undertake the above new roles, and at the same time dismissal of some others.

The adoption of CC leads also to significant changes in the roles and the skills requirements of firm’s non-ICT personnel as well (ICT users of the business units) (Willcocks et al. 2013; Willcocks et al., 2014; Ragowsky et al., 2014; Schneider and Sunyaev, 2016). Due to the large amount of existing and continuously evolving and increasing CC services offered by multiple providers, it is necessary that non-ICT personnel should participate in the exploration and processing of this extensive external knowledge (which is mainly business oriented, concerning functionalities offered, and much less technical, as the technological details of the provision of the CC services concern mainly their providers and much less their users), as well as in the decision making in respect to the kind of CC services to be used and the providers to be selected. As a

consequence the use of CC leads to a decentralization of these ICT related decisions, and a shift of decision making from the ICT unit to other business units.

However, there is a lack of empirical investigation of the effect of this CC adaptation on the extent of benefits generated from CC. Our study makes a contribution towards filling this research gap (hypothesis H1).

Absorptive Capacity

As the modern economy becomes increasingly ‘knowledge intensive’ and dynamic, the exploitation and management of external knowledge becomes critical for the success of firms; this has led to an increasing interest of both researchers and practitioners in firm’s ACAP (Cohen and Levinthal, 1989 and 1990; Zahra and George, 2002; Lane et al., 2006; Camison and Fores, 2010). According to the original publications on ACAP by Cohen and Levinthal (1989 and 1990), the ACAP of a firm has three components, which concern its ability to: 1) recognize, acquire and understand potentially valuable new knowledge from outside the firm through exploratory learning; 2) assimilate this valuable new knowledge through transformative learning; and 3) use the assimilated knowledge in order to create new knowledge and commercial outputs, and in general in order to achieve firm’s objectives, through exploitative learning. A re-conceptualization of ACAP has been proposed by Zahra and George (2002), which includes the following four components of it: a) acquisition capacity (=firm’s ability to locate, identify, value and acquire external knowledge that is critical to its operations or/and products and services); b) assimilation capacity (= firm’s ability to absorb external knowledge, through processes and routines that allow the new acquired external knowledge to be analyzed, processed, interpreted, understood, internalized and classified); c) transformation capacity (=firm’s ability to develop and refine the internal routines that facilitate the association and combination of the newly acquired external knowledge with the previous knowledge base of it); d) application or exploitation capacity: (= firm’s ability to incorporate acquired, assimilated and transformed knowledge into its operations, not only in order to refine, perfect, expand and leverage existing routines, processes, competences and knowledge, but also to create new operations, competences, routines, as well as new products and services).

ACAP is widely recognized as one of the main determinants of firm’s innovation performance (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane et al., 2006; Murovec and Prodan, 2009; Leal-Rodríguez et al., 2014), and especially important for the successful deployment, assimilation and exploitation of ICT innovations (Roberts et al., 2012). In this study we investigate empirically to what extent firm’s ACAP, by enabling the exploration, assimilation and exploitation of external knowledge of CC services, affects positively CC benefits (research hypothesis H2).

Research Hypotheses

Based on the above background we developed three research hypotheses, which concern the effects of CC adaptation actions and ACAP on CC benefits, as well as the effect of the CC benefits on firm performance. The research model of our study is shown in Fig. 1.

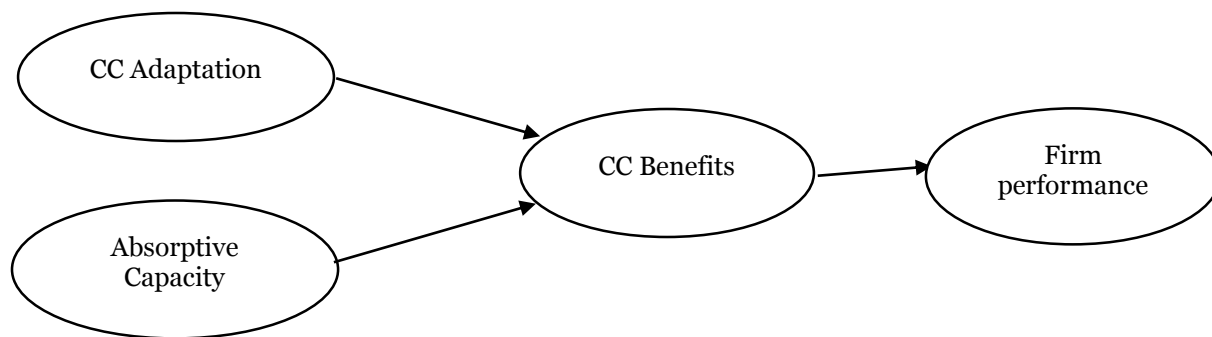


Figure 1. Research model

As mentioned in the previous section, the adoption of CC should be accompanied by changes/adaptations in the roles and skills of firm’s both ICT and non-ICT personnel (which initially are aligned with the ‘on

premises' paradigm based on the internal provision of ICT services), in order to achieve higher levels of benefits from CC (Willcocks et al. 2013; Willcocks et al., 2014; Ragowsky et al., 2014; Schneider and Sunyaev, 2016). With respect to the ICT personnel, for part of them significant changes in their duties and roles have to be made, becoming more business oriented (including cooperation with non-ICT personnel of business units for the selection of the most appropriate CC services, as well as their exploitation) and less technical; also, their technical duties will include less systems development, management and maintenance, and more integration of CC services with existing 'on-premise' systems, as well as coordination and support of external CC services procurement. Furthermore, for this part of the ICT personnel training will be required concerning 1) the technological aspects and the capabilities of CC, and 2) the operations, business processes and external environment of the firm. The above change in the composition of the duties of the ICT personnel, in combination with the new skills they will acquire through this training, will enable them to contribute significantly to a better selection of the most cost-effective and appropriate CC services for the operations, the business processes and in general the needs of the firm (in cooperation with personnel of the business units), and also to integrate these CC services with existing on-premises systems, resulting in higher ICT cost and investment reduction related benefits from CC. Also, the above will enable the ICT personnel to contribute to the identification of CC services that can enable and support beneficial innovations in firm's processes as well as products and services (also in cooperation with personnel of the business units), leading to higher innovation related benefits from CC, and more business value from it. At the same time another part of the ICT personnel might have to be dismissed, as their duties will now be undertaken by CC services providers, leading to ICT cost reduction. Furthermore, the decentralization of relevant decisions from the ICT unit to the business units of firms will increase the involvement of the ICT users (or potential users) in the exploration of the existing CC services, their assessment, and finally the selection and exploitation of the most cost-effective and suitable ones to fulfill the needs for supporting both existing operations and business processes, and also innovations in firm's processes, products and services. This involvement of ICT users can be quite valuable, due to the deep knowledge (much deeper in comparison with the ICT personnel) they have of firm's processes, and their strengths and weaknesses, as well as of firms' products and services, and also of competitors' products and services, and relevant market needs and trends; this deep knowledge will allow a much better selection and exploitation of CC services, leading to higher both ICT cost and investment reduction and innovation support oriented benefits. For the above reasons we expect that higher degree of firms' adaptation by to better align with the CC paradigm will lead to higher levels of benefits from CC. So, our first research hypothesis is:

H1. The degree of CC adaptation has a positive effect on CC benefits.

The supply of CC services by a growing network of providers is continuously evolving both quantitatively and qualitatively: on one hand it is enriched with many new CC services, while on the other hand the existing CC services are improved. Due to this continuous evolution of the CC services market, firms should have capabilities for the collection, processing and exploitation of large amounts of CC related external knowledge, concerning the numerous existing and continuously evolving CC services, as well as new CC services that are continuously developed. It is important to identify improvements of existing CC services, and also new ones, which can be useful for firms, and also to acquire and assimilate extensive knowledge on them, and exploit this knowledge for improving efficiency (e.g. for ICT or operational costs reduction) and for promoting innovation (e.g. in their processes, products, services and even business models), and in general for making a better exploitation of CC and increase the benefits from it. The ACAP of the firm is of critical importance for performing effectively the above tasks, which rely heavily on the ability of the firm to acquire, assimilate and transform relevant external knowledge and then exploit it to improve its operations, products and services, and finally to achieve firms' objectives. In general, as mentioned in the previous section the ACAP has a strong positive effect on firm's innovation performance (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane et al., 2006; Murovec and Prodan, 2009; Leal-Rodríguez et al., 2014). Especially with respect to ICT innovations, previous literature (e.g. see Roberts et al., 2012) argues that higher ACAP enables the external acquisition and exploitation of the knowledge base required for the successful deployment and assimilation of ICT innovations, as well as for their better exploitation in order to generate more business benefits. As the adoption and use of CC is an important innovation concerning the acquisition of ICT services required for supporting firm's activities and operations, we expect that ACAP will have a positive effect on it. We expect that firms with higher ACAP might be better positioned to continuously explore, acquire, manage, assimilate and exploit the exiting extensive and

continuously evolving external knowledge concerning CC services offerings, and this will result in higher levels of CC benefits. Thus, our second hypothesis is:

H2. Firm's ACAP has a positive effect on CC benefits.

The benefits generated from the use of CC, both the efficiency related ones (concerning the reduction of ICT and business processes costs), as well as the innovation oriented ones (concerning the support of innovations in firm's processes, products and services), can result in significant improvements in firm performance. In particular, the low cost support of product and service innovations enabled by CC is expected to increase firms' sales revenue and market share. At the same time the capabilities for ICT and business processes' costs reduction that CC provides, as well as the low cost support of process innovations it enables, are expected to reduce firms' operating costs. As the benefits that CC offers can result in both the increase of sales revenue and the reduction of operating costs, they can lead to higher profitability. Furthermore, the use of CC can enable a firm to operate efficiently with less ICT assets (e.g. less hardware and software), relying on corresponding CC services. These can increase firm's return on investment (=profits divided by the total assets of the company). For the above reasons we expect that CC benefits can contribute to the improvement of a firm's performance. For these reasons our third hypothesis is:

H3. CC benefits have a positive effect on firm performance

Data and Method

For this study we used firm level data collected through a survey of Dutch firms that use SaaS services. Initially the questionnaire of the survey was developed, pre-tested by three colleagues, who are quite experienced in surveys and quantitative research. Based on their remarks improvements and clarifications of some questions were made, and the final version of the questionnaire was prepared. Then we contacted two important Dutch SaaS providers (offering mainly financial software as a service), who agreed to send the survey questionnaire through e-mail to their customers, and ask them to fill it and return it to us by e-mail within a month. In this way the questionnaire was sent to the CEOs of 600 firms. The firms that did not return it in the above time frame were reminded by email. We finally managed to collect filled questionnaires from 102 firms; 70.6% of them are small, having less than 50 employees, while the remaining 29.4% were medium or large, having more than 50 employees.

All four main constructs of our study (CC adaptation, ACAP, CC benefits, firm performance) were measured using multi-item scales (see Appendix), which were developed based on previous literature. The CC adaptation actions construct was measured using a six items scale, which has been developed based on previous qualitative research on the adaptations that CC necessitates in the roles and skills of firm's ICT and non-ICT personnel (Willcocks et al. 2013; Willcocks et al., 2014; Ragowsky et al., 2014; Schneider and Sunyaev, 2016). The ACAP construct was measured using a seven items scale adapted from Roberts (2015). The CC benefits construct was measured through a five items scale developed based on previous literature on the benefits offered by CC (Marston et al., 2011; Venders and Whitley, 2012; Müller et al., 2015). Finally, the firm performance construct was measured using a four items scale from Chen et al. (2014). The respondents were asked to answer the questions concerning CC adaptation, ACAP and CC benefits using a 5-levels Lickert-type scale, where 5 = to a very large extent, 4 = to a large extent, 3 = to a moderate extent, 2 = to a small extent, and 1 = not at all; and the questions concerning firm performance similarly in a 5-levels Lickert-type scale, ranging from 1 to 5, where 5 = much higher than the average of competitors, 4 = higher than average, 3 = about at the average, 2 = below the average, and 1 = much lower than the average.

In order to test our research hypotheses H1 – H3 the model shown in Fig.1 was estimated using the above data through partial least squares SEM, which according to relevant literature is the most appropriate approach if the sample size is small (Wang, 2013), conducted using the SmartPLS software.

Results

The reliability of the indicators, as well as the internal consistency reliability and the convergent validity of the constructs, and also their discriminant validity were examined following the procedures suggested by Wang (2013). All the outer model loadings of the items are significant and exceed the suggested minimum 0.632 level. From this, it can be concluded that all these indicators have acceptable reliability. For assessing the internal consistency reliability of our four constructs Cronbach's alpha and the composite reliability value were calculated as shown in Table 1. For all constructs Cronbach's alpha exceeds the suggested minimum level of 0.7, and also composite reliability exceeds the minimum level of 0.7. The convergent validity of our constructs was assessed by calculating for each of them the Average Variance Extracted (AVE), which is shown in the last column of Table 1; for all constructs the AVE value exceeds the minimum acceptable value of 0.5, so they all possess convergent validity.

	Cronbach's alpha	Composite reliability	AVE
CC Adaptation	0.875	0.905	0.614
ACAP	0.849	0.877	0.507
CC Benefits	0.814	0.867	0.528
Firm performance	0.807	0.825	0.630

Table 1. Cronbach' alpha, composite reliability and AVE values

Finally, for assessing the discriminant validity of our four constructs we used the criterion of Fornell and Larcker (1981), suggesting that the square root of the AVE of each construct should be larger than its correlations with all other constructs. In Table 2 are shown in bold the square roots of the AVE values of the constructs on the diagonal of the table, and the correlations between the constructs in the lower off-diagonal cells. The Fornell - Larcker criterion is fulfilled for all constructs (for all of them the square root of the AVE is larger than the correlations with other constructs), indicating discriminant validity.

	CC Adaptation	ACAP	CC Benefits	Firm performance
CC Adaptation	0.784			
ACAP	0.021	0.712		
CC Benefits	0.525	0.290	0.727	
Firm performance	0.189	0.189	0.347	0.794

Table 2. Fornell - Larcker criterion test – Constructs' Correlations and SQRT(AVE)

The structural part of the model (inner model) is shown in Fig.2. All three paths are positive and statistically significant, so all our hypotheses H1-H3 are supported. Taking into account the suggestions of Wang (2013) that a path coefficient of 0.15 indicates a medium effect, while one of 0.35 indicates a strong effect, we can conclude that CC adaptation actions have a very strong positive effect on CC benefits (path coefficient 0.519). Furthermore, the ACAP has a weaker medium to strong effect on CC benefits (path coefficient 0.279). Finally the benefits offered by CC have a strong positive effect on firm performance (path coefficient 0.347).

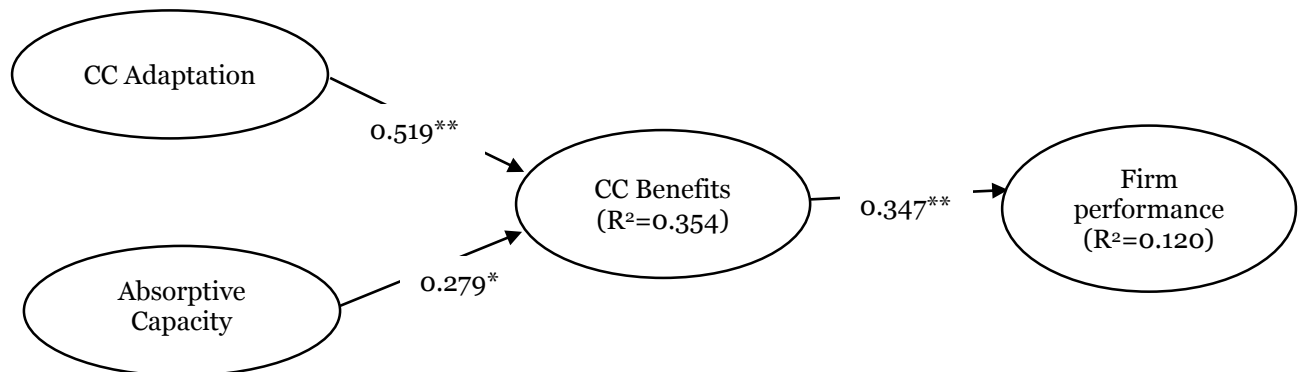


Figure 2. Structural (inner) model

Conclusions

Limited empirical research has been conducted for gaining a better understanding of the determinants and preconditions of CC benefits; this knowledge is very useful, as it will allow us to gain more benefits from CC, and to exploit better the business value potential of CC in order to improve business performance. This study contributes to addressing these important research gaps, by investigating empirically 1) the effects of firm's adaptation actions and ACAP on the benefits gained from CC; and 2) the impact of these CC benefits on firm performance. Our research model has been validated using data collected through a questionnaire from 102 Dutch firms using SaaS services, which have been used for the estimation of a SEM.

The adaptation from the 'on premises' to the CC paradigm was found to have a very strong positive effect, while ACAP has a medium to strong positive effect, on the benefits gained from CC. Furthermore the resulting CC benefits have a strong positive effect on firm performance. The above results provide evidence that making the required adaptations of the roles and skill-sets of both ICT and non-ICT personnel is of critical importance for exploiting the benefits potential of CC, as the existing roles and skill-sets correspond to the previous on-premises paradigm of ICT services acquisition. For gaining high levels of benefits from CC it is important to ensure that ICT personnel evolve, from having mainly technical skills and roles, concerning mainly the development, management and maintenance of on-premises systems, towards new more business-oriented skills and roles. ICT personnel should be able to communicate and co-operate with business units for the coordination and support of CC services procurement, the negotiation and monitoring of CC contracts, and also the exploitation of these CC services. Also their technical skills should evolve towards systems/services integration. At the same time the personnel of the business units should undertake more responsibilities for the ICT support of their activities, and have a stronger involvement in the assessment and selection of relevant CC services, supporting an increasing decentralization of relevant decision making. Furthermore, our results indicate that due to the extent, the complexity and the rapid evolution of CC services supply, firm's ACAP becomes highly important for taking advantage of CC. ACAP enables the firm to recognize, acquire, assimilate, apply and exploit external CC related knowledge, leading to higher levels of benefits from CC. Finally, the abovementioned strong effects of CC benefits on firm performance indicate that the business value that CC generates is considerable.

Our study has interesting implications for research and practice. Our study contributes to the enrichment of the limited research literature on the determinants of CC benefits and the importance of the latter for firm performance. Our study investigates the impact on CC benefits of two factors associated with 'change': the changes-adaptations that have to be made by firms to this new paradigm of ICT services acquisition with respect to the skills and roles of ICT and non-ICT personnel; and also firm's ACAP (an important dynamic capability). With respect to practice, the statistical significance of the above effects, as well as their magnitudes, indicate that the benefits that a firm can gain from CC are not straightforward, but requires significant adaptations to be made in the roles and the skill-sets of firm's personnel. The degree of benefits realization from CC relies heavily on the degree of being able to adapt to CC, providing leadership and direction, as well as training, and also overcoming possible resistances (e.g. by ICT personnel whose role, duties and skills will have to change significantly, and also the ones who have to be dismissed). Furthermore, the benefits to be gained from CC rely heavily on firm's ACAP, which enables the firm to acquire, manage, assimilate and exploit extensive CC related external knowledge.

Our study was limited to two SaaS providers within the financial industry. Further empirical research is required on the effects of the above two factors on the benefits gained by other types of organizations in different industries, and for other levels of CC services (e.g. IaaS, PaaS). Also, it is necessary to investigate empirically the effects on CC benefits on other factors, both internal (e.g. firm characteristics) and external (e.g. concerning CC providers, external environment).

REFERENCES

- Armbrust, M., Fox, A., Griffith, R., Joseph, A., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica I. and Zaharia M. (2010). "A view of Cloud Computing", *Communications of the ACM* (53:4), pp. 50- 58.
- Bayramustaa, M. and Nasirb, V. A. (2016). "A fad or future of IT?: A comprehensive literature review on the cloud computing research", *International Journal of Information Management* (36:4), pp. 635-644.
- Benlian, A. and Hess T. (2011). "Opportunities and Risks of Software-as-a-Service: Findings from a Survey

- of IT Executives”, *Decision Support Systems* (52:1), pp. 232-246.
- Berman, S., Kesterson-Townes, L., Marshall, A. and Srivathsa, R. 2012. “The power of cloud - Driving business model innovation”. *IBM Institute for Business Value*, New York, USA.
- Brynjolfsson, E., Hofmann, P. and Jordan, J. (2010). “Economic and Business Dimensions - Cloud Computing and Electricity: Beyond the utility model”, *Communications of the ACM* (53:5), pp. 32-34.
- Camisón, C. and Forés, B. (2010). “Absorptive Capacity: New Insights for Its Conceptualization and Measurement”, *Journal of Business Research*, (63:7), pp. 707-715.
- Chen, Y., Wang, Y., Nevo, S., Jin, J., Wang, L. and Chow, W. S. (2014). “IT capability and organizational performance: the roles of business process agility and environmental factors”, *European Journal of Information Systems*, (23:3), pp. 326-342.
- Cohen, W. M. and Levinthal, D. A. (1989). “Innovation and Learning: The Two Faces of R&D”, *Economic Journal*, (99:397), pp. 569-596.
- Cohen, W. M. and Levinthal, D. A. (1990). “Absorptive Capacity: A New Perspective on Learning and Innovation”, *Administrative Science Quarterly* (35:1), pp. 128-152.
- Etro, F. (2009). “The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe”, *Review of Business and Economics* (54:2), pp. 179-208.
- Fornell, C. and Larcker, D. F. (1981). “Evaluating structural equation models with unobservable variables and measurement error”, *Journal of Marketing Research*, (18:1), pp. 39-50.
- Garrison, G., Wakefield, R. L. and Kim, S. (2015). “The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations”, *International Journal of Information Management* (35:4), pp. 377-393.
- Hoberg, P., Wollersheim, J., Krcmar, H. (2012). “The business perspective on cloud computing - A literature review of research on cloud computing”, *Proceedings of the American Conference on Information Systems (AMCIS) 2012*.
- Iyer, B. and Henderson, J. C. (2010). “Preparing for the Future: Understanding the Seven Capabilities of Cloud Computing”, *MIS Quarterly Executive* (9:2), pp. 117-131.
- Iyer, B. and Henderson, J. C. (2012). “Business Value from Clouds: Learning from Users”, *MIS Quarterly Executive* (11:1), pp. 51-60.
- Lane, P. J., Koka, B. R. and Pathak, S. (2006). “The Reification of Absorptive Capacity: A Critical Review and Rejuvenation of the Construct”, *Academy of Management Review*, (31:4), pp. 833-863.
- Leal-Rodríguez, A. L., Ariza-Montes, J. A., Roldán, J. L. and Leal-Millán, A. G. (2014). “Absorptive capacity, innovation and cultural barriers: A conditional mediation model”. *Journal of Business Research*, 67(5), 763-768.
- Marston, S., Li, Z., Brandyopadyay, S., Zhang, J. and Ghalsasi, A. (2011). “Cloud Computing – The Business Perspective”, *Decision Support Systems*, (51:1), pp. 176-189.
- Mell, P. and Grance, T. (2011). “The NIST definition of cloud computing”. National Institute of Standards and Technology (NIST), pp. 1-3.
- Müller, S. D., Holm, S. R. and Søndergaard, J. (2015). “Benefits of cloud computing: literature review in a maturity model perspective”. *Communications of the Association for Information Systems*, 37, pp. 851 - 878.
- Murovec, N. and Prodan, I. (2009). “Absorptive capacity, its determinants, and influence on innovation output: Cross-cultural validation of the structural model”. *Technovation*, (29:12), pp. 859-872.
- Ragowsky, A., Licker, P., Miller, J., Gefen, D. and Stern, M. (2014). “Do Not Call Me Chief Information Officer, But Chief Integration Officer: A summary of the 2011 Detroit CIO roundtable”. *Communications of the Association for Information Systems*, (34:1), pp. 1333-1346.
- Roberts, N., Galluch, P. S., Dinger, M., and Grover, V. (2012). “Absorptive capacity and information systems research: Review, synthesis, and directions for future research”, *MIS Quarterly*, 36(2), 625-648.
- Roberts, N. (2015). “Absorptive capacity, organizational antecedents, and environmental dynamism”. *Journal of Business Research*, (68:11), pp. 2426-2433.
- Schneider, S., & Sunyaev, A. (2016). “Determinant factors of cloud-sourcing decisions: reflecting on the IT outsourcing literature in the era of cloud computing”. *Journal of Information Technology*, (31:1), pp. 1-31.
- Venters, W. and Whitley, E. (2012). “A Critical Review of Cloud Computing: Researching Desires and Reality”, *Journal of Information Technology* (27:3), pp. 179-197.
- Wang, K. (2013). “Partial Least Squares Structural Equation Modeling (PLS-SEM) Techniques Using SmartPLS”, *Marketing Bulletin*, (24:1), pp. 1-32.
- Willcocks, L., Venters, W. and Whitley, E. A. (2013). “Cloud sourcing and innovation: slow train coming?”,

Strategic Outsourcing: An International Journal, (6:2), pp. 184 – 202.
Willcocks L., Venters W. and Whitley E. A. (2014). *Moving to the Cloud Corporation*. Palgrave Millan: UK.
Zahra, S. A., and George, G. (2002). “Absorptive Capacity: A Review, Reconceptualization, and Extension”,
Academy of Management Review, (27:2), pp. 185-203.

APPENDIX – Constructs’ measurement items

Cloud computing adaptation actions

To what extent in your company the adoption of SaaS has been accompanied by the following actions of adaptation to this new ICT services acquisition model:

- provision of training on cloud computing to your ICT personnel
- provision of training on the operations and business processes of your company to your ICT personnel
- dismissal of part of your ICT personnel
- decentralization of ICT related decisions from the ICT unit/group to the other business units that use ICT for supporting their work and activities
- make changes in the role of the ICT unit/group from systems management and maintenance towards the coordination and support of external CC services procurement
- make changes in the technical role of the ICT unit/group from development of systems towards the integration of CC services with existing ‘on-premise’ systems

Absorptive capacity

To what extent your company can

- easily recognize innovations from external parties (such as suppliers, partners and universities)
- integrate external acquired knowledge within the company resulting in improvements
- understand and assimilate external knowledge
- enrich its knowledge with external knowledge
- exploit this newly acquired external knowledge, in combination with existing internal knowledge, for concrete applications
- exploit newly acquired external knowledge for the development of new products/services
- enrich its own knowledge base with external parties’ knowledge in order to achieve competitive advantage

Cloud computing benefits

To what extent the use of SaaS by your company has provided the following benefits :

- cost reduction
- freeing up capital due to lower needs for ICT investments
- made it easier for you to innovate and introduce new products and services
- supported the rapid and low-cost introduction of process innovations
- made it easier for you to respond more quickly to changes in your external environment (for instance introduction of new products/services by competitors, changes in the demand for your products/services, changes in customer needs and preferences, etc.) – increased your business agility

Firm performance

How good has been your financial performance in the last three years in comparison with your competitors in terms of

- profitability
- sales increase
- market share
- return on investment (ROI) (profits divided by the total assets of the company)